Space Weather Technical Forecast

Issued on Saturday, 29 October 2022 at 13:27 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Risk of G1/Minor Storms throughout.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity has been low over the last 24 hours, with several low energy C-class flares observed. There are six sunspot regions on the visible disc with AR3135 (Dso/Beta) showing the most development, although AR3131 (Cho/Beta) has shown some signs of growth. AR3130 and AR3133, both Dai/Beta, have not developed significantly, with the remaining two spots fading. No Earth-directed CMEs have been observed.

Solar Wind / Geomagnetic Activity: The solar winds, observed by DSCOVR at L1, started at around 425km/s but have fitfully increased to average between 500-600km/s since 29/0045UTC, with a peak of 610km/s at 29/0952UTC. This is due to a connection with the high speed stream from coronal hole 36 and perhaps a concurrent connection with the high speed stream from coronal hole 37. Density was just above average for much of the period, with several peaks of around 16 ppcc. Total interplanetary magnetic field strength was moderate for much of the period, reaching a peak of 11nT at 29/0013UTC, but has steadily declined over the last 6 hours to weak values. The north-south component, Bz, has varied between peaks of +/-10nT over the last 24 hours, with a bias to moderately negative Bz values. Phi angle started negative (towards the Sun, but has been predominantly positive since 28/1519UTC. Geomagnetic activity started the period Quiet, but has been mainly Active since 28/1500UTC, with two G1/Minor Storm periods, 28/1500-1800UTC and 29/0600-0900UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has remained at background levels. High energy electron flux (greater than 2MeV) at GOES-16 was at background levels. The associated 24-hour integrated fluence was below the Active (1e8 integrated pfu) threshold, with 1.65e6 integrated pfu observed at 29/0000 UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: Solar activity is expected to be mainly Low, with a slight chance of isolated M-flares.

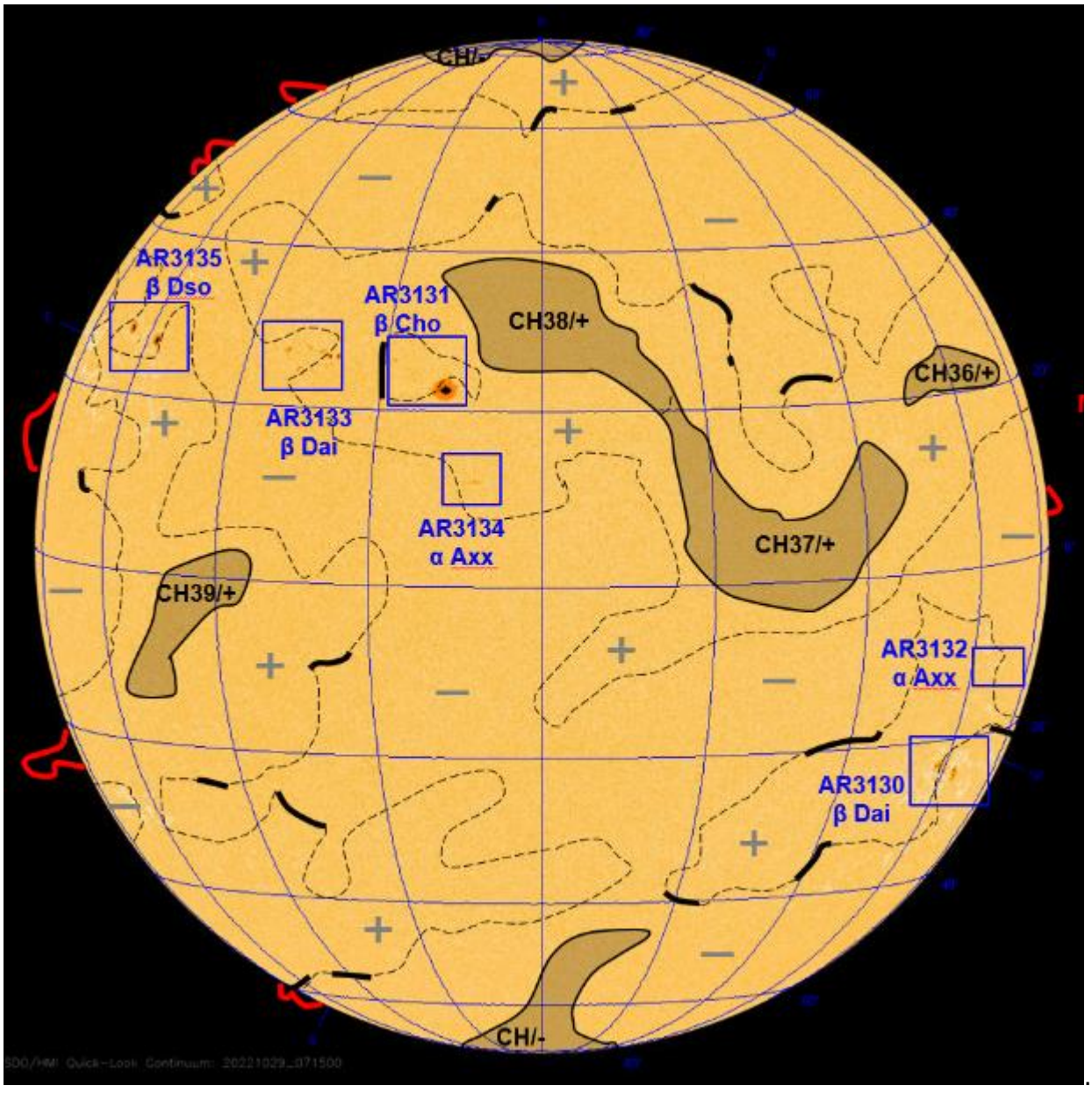
Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are forecast. Earth is currently under the influence of a high speed stream from possibly a combination to coronal hole 36 and 37. A further high speed stream from coronal hole 38 is then likely to connect with Earth later in the period. Speeds of 500-600km/s are expected but with a declining trend. Geomagnetic activity is expected to be mainly Unsettled to Active, with a likelihood of G1/Minor storms on 29 October, then mainly Quiet to Unsettled, with a declining risk of Active or G1/Minor Storm intervals through the remainder of the period.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) observed by GOES-16 is expected to be at background levels. High energy electron flux (greater than 2MeV) observed by GOES-16 is forecast to be at background to moderate levels between 29 to 31 October, likely only rising on 01 November as solar wind pressure decreases. The associated 24 hour electron fluence is expected to remain below the Active (1e8 integrated pfu) threshold until 01 November when an increasing trend is forecast.

Figure 1. Solar Analysis Valid 29/0800UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Geomagnetic Storms:

No Earth-directed CMEs are forecast.

The Earth is currently under the influence of the high speed stream from positive coronal hole 36 with a contribution from coronal hole 37, with speeds of 500-600km/s observed. These holes are followed in the northern hemisphere by coronal hole 38. Based on observations from the last rotation where speeds of around 500km/s were observed, and as these are all recurrent holes and appear stronger on this rotation, speeds of 500-600km/s are forecast throughout the forecast period. However using recurrence as a guide, the peak speeds are likely to decline towards the end of the period.

Geomagnetic activity is expected to be mainly Unsettled to Active on 29 October, with a likelihood of G1/Minor Storms. Quiet to Unsettled conditions are then forecast for the remainder of the period, but with a possibility of further storming when elevated winds combine with sustained periods of negative Bz.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	60	20	20	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: 24 hour observed solar wind parameters

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

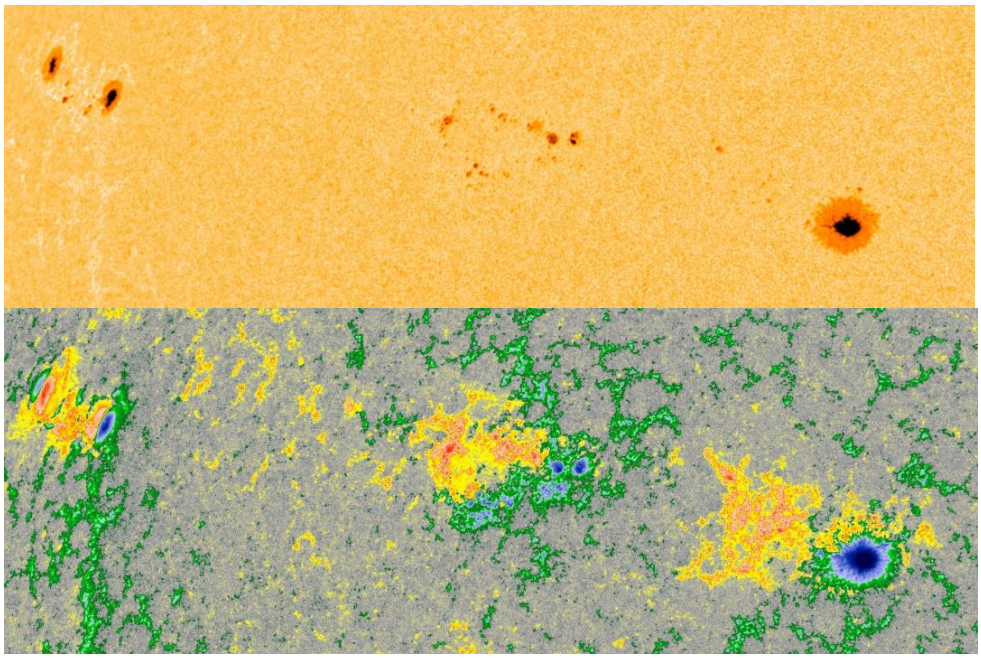
Radio Blackouts - X-Ray Flares:
There are six sunspots on the visible disc, with the most significant of these AR3131 (Cho/Beta) and AR3135 (Dso Beta) both in the northeast quadrant. Both of these regions have undergone recent development and present a heightened risk of M-class flaring. AR3130 and AR3133, both Dai/Beta have not shown significant development in the last 24 hours, with the remaining regions weak and fading.

A number of regions are forecast to rotate onto the disc across the eastern limb through the forecast period, which could further increase risk values.

Solar activity is expected to be mainly Low, with a slight chance of Moderate activity, mainly concentrated in the two developing regions in the northeast quadrant.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	15	15	15	15
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: AR3135 (far left) and AR3131 (far right) on SDO HMI intensitygram imagery (top) and magnetogram imagery (bottom).



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES-16 is currently at background and is currently expected to remain at this level through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The elevated solar wind speeds are likely to compress the radiation belts out of their natural orbits through 29 to 31 October due to the solar wind pressure exerted on the belts. There may be brief rises in the electron flux during any short relaxation of the wind speeds, particularly in the transition between coronal holes. Towards the end of the period the combination of a build up of radiation into the belts from the solar wind, and the potential easing of the solar wind, could result in a sharp increase in the electron flux, potentially reaching diurnal peaks above the high (1e3pfu) threshold by 01 November.

Electron fluence is expected to remain below the Active (1e8 integrated pfu) threshold for much of the period in a suppressed electron flux environment, but with a steady increase towards the high threshold by the end of the period as flux levels increase.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	20	20	60
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.